

Comparison of Various Smoke Detector Distribution Methods.

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Abstract: Four different smoke detector distribution methods were conducted and evaluated in different communities in Southeast Alaska between February, 1988 and March, 1989. The “cost” distribution method was found to be more effective than distribution for free. In-home follow-up surveys showed that 47% of the participants in the “cost” group had properly installed and operating detectors compared to only 32% in the “free” group. The “cost”-distribution method utilizing community groups was also found to be the least expensive method to coordinate.

The fire death rate in Alaska has been higher than the national fire death rate. Between 1979 and 1987, an average of 26 persons in Alaska have died from fire each year. This rate was 2.5 times greater than the national average. In 1987 the fire death rate for non-native Alaskans was 3.0/100,000. During the same year the death rate for native Alaskans was 12.3/100,000.¹ The national rate for deaths due to residential fires was 2.5/100,000 in 1987.²

The installation of smoke detectors has been proven to provide an early warning to residents and to greatly reduce deaths due to fires.^{3,4,5} Because of the high injury and death rate due to fire in Alaska, the Southeast Alaska Regional Health Corporation (SEARHC) initiated this study to determine the most effective method to distribute smoke detectors in the predominantly native villages of Southeast Alaska (SEA).

Methods:

A pre-study random survey was conducted to determine if the predominantly native rural communities in SEA could benefit from a smoke detector distribution program. The house-to-house, pre-study survey was conducted to estimate the number of homes that had properly-placed and operating smoke detectors. National Fire Protection Association (NFPA) 74-1984 guidelines were used to analyze the placement and performance of the detectors. After determining that the level of smoke detector usage in the community surveyed was far below reported use rates for the rest of the nation, a smoke detector distribution experiment was conducted. Figure 1 diagrams the distribution methods and the villages in which each of the methods was used.

FIGURE 1: Distribution Methods				
Village	Fire Department		Mobile Van**	
	Free*	Cost	Free	Cost
A		B&F	C	D&E

* Units installed by a fire department member.

In village A the fire department personnel distributed and installed free smoke detectors door to door. Due to manpower shortages in villages B and F, fire department personnel asked community groups to distribute the smoke detectors charging \$5.00 for each unit. In village B a summer youth group distributed the detectors door to door. In village F the Cub Scouts did the same. Home occupants were responsible for the installation in villages B and F.

In village C, free detectors were distributed from a mobile van parked at the fire department. Home occupants were responsible for installation of these units. In Villages D and E, smoke detectors were distributed from the mobile van parked at the community center. Home occupants were again responsible for the installation of the units. Lists of the recipients were recorded for each of the distribution methods to be used for evaluation of each of the methods four to seven months later.

The distribution was to be conducted in only 4 villages, utilizing one of the four different methods in each of the villages. 50 detectors were to be distributed in each of the villages. However, distributing the detectors at cost proved to be much more difficult than distribution for free. Therefore, to expedite the study, detectors were distributed in two additional villages by using the “cost” method. Also, when the study was originally designed, it was thought that the fire department personnel would install the units in both the “free” and “cost” groups in villages A, B and F. However, due to a shortage in manpower, the fire departments responsible for the distribution of the detectors for a cost elected to use community groups to do the distribution.

In all methods, the occupants were urged to participate in the program on the basis of the life-saving potential of the detectors. With the distributions from the van, all of the detectors were simply given to participants with the manufacturer’s instructions, requiring the residents to install the detectors themselves. In all of the distribution methods, the advertisement for the distribution event was conducted by the local fire department.

The smoke detectors were the ionizing type and each came with a 9-volt battery provided by the manufacturer. The complete units and instructions were identical among the groups. Each of the detector units were etched on the

inside metal buzzer for identification upon re-inspection during the follow-up phase. The follow-up phase involved inspection of as many of the detectors as possible with 3 attempts during a two-day period made 4-7 months after the distribution. Inspections were unannounced and were conducted by three persons. NFPA 74-1984 guidelines were used to analyze the placement and performance of the detectors.

Results

The results from the pre-study survey are listed in Table 1. 61 randomly selected homes were surveyed. Of these, 43% did not have any type of detector. The survey revealed that the percentage of properly installed and working smoke detectors in this rural Alaskan community was 16% (95% CI=7, 25).

Table 2 identifies the operating condition of 35 detectors found in pre-study homes. Of these detectors, 43% were not operating. These units either were malfunctioning or had no power supplied to them. 29% of the detectors present in homes were actually properly installed and working.

TABLE 1: Pre-Study Survey Results		
	<u>Number</u>	<u>% of Surveyed</u>
No Detector	26	(43%)
Had in box, Not installed	5	(8%)
Not Operating	15	(25%)
Improperly Installed	5	(8%)
Properly Installed and Working	10	(16%)
Total Homes Surveyed	61	

TABLE 2: Pre-Study Survey Results For Those Homes With Detectors Present		
Had in Box, Not Installed	5	(14%)
Not Operating	15	(43%)
Improperly Installed	5	(14%)
Properly Installed and Working	10	(29%)

Table 3 identifies the number of detectors distributed with each of the four methods. A combined total of 150 detectors were distributed in six different communities, utilizing four different distribution methods.

TABLE 3: Number of Detectors Distributed by Using Each of the Methods					
	<u>Fire Department</u>		<u>Mobile Van</u>		<u>Total</u>
	<u>Free</u>	<u>Cost</u>	<u>Free</u>	<u>Cost</u>	
# of Detectors Distributed	24	40	50	36	150

Table 4 lists the disposition of the detectors that were distributed as noted during the follow up surveys.

TABLE 4: Follow-up Survey Results						
	<u>Fire Department</u>		<u>Mobile Van</u>		<u>Total</u>	<u>Pre-Study Survey</u>
	<u>Free</u>	<u>Cost</u>	<u>Free</u>	<u>Cost</u>		
No detector	*	*	*	*	*	26
Not installed	3	19	30	12	64	5
Not operating	6	1	4	2	13	15
Improperly installed	0	0	1	0	1	5
Properly installed & working	10	15	11	15	51	10
Total Surveyed	19	35	46	29	129	61

* Information Not Collected

Table 5 compares the effectiveness of the distribution methods. The number of properly installed and working detectors is divided by the total number of detectors followed up. Of the “free” units, 21/65 (32%) were properly installed and working, compared with 30/64 (47%) of the “cost” units ($\chi^2 = 2.88, p < .10$).

TABLE 5: Results from the Follow-up Surveys of the Distribution						
(# of Detectors Properly Installed and Working / # of Detectors Followed Up)						
	<u>Fire Department</u>		<u>Mobile Van</u>		<u>Total</u>	
Free	10/19	(53%)	11/46	(24%)	21/65	(32%)
Cost	15/35	(43%)	15/29	(52%)	30/64	(47%)
Total	25/54	(46%)	26/75	(35%)	51/129	(40%)

However, since one group of recipients in the “free” distribution was not responsible for the installation of their units, a “free” versus “cost” comparison becomes more meaningful if the units installed in the fire department free group are excluded from the comparison. The comparison of “free” versus “cost” is then 11/46 (24%) properly

installed and working for those distributed for free, versus 30/64 (47%) properly installed and working in the “cost” distribution ($\chi^2=5.92$, $p < .025$). Free distribution from the mobile van where 11/46 (24%) were properly installed and working was also significantly less effective when compared to the 3 other methods combined which had 40/83 (48%) properly installed and working ($\chi^2=7.31$, $p < .01$).

Table 6 compares the number of detectors in the follow-up survey with the battery disconnected to the number of detectors which were installed. Those detectors distributed for free were more likely to have the battery disconnected than those which were distributed for a cost. Of those detectors installed, 31% distributed for free had the battery disconnected, compared to 9% of those distributed at cost ($\chi^2 = 4.96$, $p < .05$).

TABLE 6: Results of Follow-up Survey of Those Units with Batteries Disconnected					
(# of Detectors With Batteries Disconnected/# of Detectors Installed)					
	<u>Fire Department</u>		<u>Mobile Van</u>		<u>Total</u>
Free	6/16	(38%)	4/16	(25%)	10/32 (32%)
Cost	1/16	(6%)	2/17	(12%)	3/33 (9%)
Total	7/32	(21%)	6/33	(19%)	13/65 (20%)

Discussion

The national average for smoke detector ownership was reported to be about 75% for all homes in 1985.⁶ No comprehensive study has been conducted to determine the detector ownership percentage in Alaskan homes, but the pre-study survey (see Table 1) indicated that the ownership level in rural Southeast Alaska is much lower than the national level. In the community where the pre-study survey was conducted, ownership was estimated to be 57%. The survey indicated that only 7-25% of homes in the community had properly-installed and operating units.

While there are several studies that evaluate the effectiveness of smoke detectors and other injury-control devices, there are very few that evaluate cost distributions to free distributions. Dershewitz⁷ compared the use of free kindergards (cabinet childproofing devices) with the use of free electrical outlet covers. The results were that the electrical outlet covers were more likely to be used because the action for the outlet covers required minimum time and effort, whereas the kindergards required some mechanical ability and more effort. Reisinger and Williams⁸ found that infant car seats offered free of charge were seldom used. Spiegel and Lindaman⁹, in a 4-part health education program in which one component involved the distribution of free window guards, demonstrated a substantial reduction in accidental falls from windows in apartment buildings.

Several problems were encountered during our program. Since the rural villages had only small volunteer fire departments, it was difficult to motivate the volunteers to contribute their time and effort. In two villages, B and F, the fire department would do the distribution only through community youth groups. In village A, the fire department was able to install only 24 detectors. The remaining 26 detectors that were sent to that village were lost. Distribution from the mobile van required much more time when charging the nominal fee of \$5.00 than when distributing the units for free. Using the “cost” distribution method from the mobile van required travel to two villages to distribute a total of 36 detectors. During the “Free” distribution from the mobile van, 50 detectors were distributed in one village. However, the number of properly installed and working detectors found during the follow-up made it clear that a larger distribution is not always a more successful program.

Our results are similar to the results obtained in a previous study⁴ which involved pediatric counseling of parents as to the importance of smoke detectors and then offered the chance to purchase a detector for \$9.50. Results were collected from in-home surveys made 4-6 six weeks after the sale. 47% (26/55) of the parents without smoke detectors purchased and correctly installed detectors. The participants in the two “cost” study groups in our smoke detector distribution had 30/64 (47%) of the detectors correctly installed and operating.

Many of the detectors in the pre-study survey (15/35, 43%, Table 2) and follow-up surveys (13/65, 20%, Table 4) were not operating properly for two major reasons. First, many of the HUD detectors were wired into the 110-volt power supply and failed due to power outages and fluctuations. Second, many of the units had been disconnected due to false (nuisance) alarms. All of the non-operating units in the follow-up survey had the battery disconnected.

Several factors may contribute to the large number of detectors which have the batteries disconnected. Smaller home sizes, combined with common cultural and lifestyle factors in rural Southeast Alaska, create a difficult environment for proper smoke detector utilization. Most of the homes in rural Alaska either heat entirely or supplement other heat sources with wood stoves.¹⁰ The diet of many rural Alaskans often consists of a large amount of fried foods that produce smoke during preparation. Of the 65 units that were installed, the units distributed free were more likely to have the batteries disconnected at follow-up (Table 6). Of the four distribution methods, the detectors most likely to have the batteries disconnected had been installed at no cost by fire department personnel.

The residents who received their units at a reduced cost apparently had more incentive to make adjustments in their homes to enable the smoke detector to perform properly. New types of smoke detectors are now available that will deactivate at the press of a button. These detectors automatically reactivate after a few minutes. They have been developed to discourage disconnecting the batteries during a false alarm.

A cost analysis of coordinating the detector distribution on a regional scale is shown in Table 7. The least expensive method to coordinate (per detector properly installed and working) was a combined effort of a community group and the local fire department. The coordination cost of \$24.33 per unit was less than half of the next expensive method. With this method, a community group such as the Cub Scouts can utilize the distribution program as a fund-raising event. Without much effort, the fire department can add credibility and supervision to the program. The amount of manpower needed to reach all of the residents is spread across a group that has a vested interest in the distribution program.

TABLE 7: Cost Analysis of Coordinating Distribution Methods (Costs listed are for the Southeast Alaska Regional Health Corporation only)				
	Fire Department		Mobile Van	
	Free	Cost	Free	Cost
Staff Time*	\$200	\$100	\$200	\$400
Per Diem**	90	90	180	360
Detector Cost	250	175	230	0
Van Transportation	0	0	175	350
Totals	540	36	785	1110
# detectors properly installed/working	10	15	11	15
Cost/unit properly installed/working	\$54.00	\$24.33	\$71.36	\$74.00

*Based on a rate of one eight hour day = \$100.

**Based on a per diem rate of \$90/day.

Fire safety initiatives targeted at residents are the key to any major reduction in the overall fire death rate.¹¹ The relative risk of being killed in a fire in a home without a smoke detector compared to homes with a detector has been estimated to be 2.5:1.³ To reduce the abnormally high fire death rate to Natives in Alaska, a public health initiative should be developed and implemented to address the inadequate use of smoke detectors in rural Alaska.

Considerations when designing and implementing smoke detector distribution programs include the following:

- The distribution program should attempt to reach the population that will benefit most. It often seems those persons who participate in a public health program are not the persons who are most at-risk.
- The distribution should involve a cross-section of people and organizations in the community to get as many people involved as possible. There should incentives for persons who conduct the distribution.
- The distribution and installation should involve the recipient and include some type of incentive.
- In this study, the incentive was a fee charged for the detector. Smoke detectors are a relatively low-maintenance injury-control device. Once a detector is installed and operating properly, it will provide early warning in the event of fire for a relatively long period of time. In contrast, other injury prevention devices such as seat belts require frequent effort. Incentive programs, fund-raising drives, or contests may also be effective in promoting proper use and maintenance of smoke detectors.

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